Office. Economics Building 105

Meetings. Tuesdays and Thursdays from 9:30 AM - 10:45 AM in Economics Building 5.

Office hours. Thursdays 3:30 PM - 5:30 PM and by appointment. For appointment send an email to carlos.martins@colorado.edu.

Class URL. http://spot.colorado.edu/∼martinsc/ECON_8828.html

Prerequesites. ECON 7828 (or equivalent) or consent of instructor.

Objectives. 1) Have advanced knowledge of estimation and inference methods used for nonparametric statistical models. 2) Be able to program and implement the various estimators and test procedures discussed in class.

Grades. Your course grade depends on homework sets a final examination and a research project. The research project is a 10 to 15 page long research proposal. It should include an introduction that convinces the reader of the relevance of your research/contribution, a review of the relevant literature, and if applicable, the methodology to be used. Relevant dates are given below.

Evaluation	Points	Date
Homework sets	40	TBA in class
Project	30	due 12.2.10 by 3:00 PM
Final	30	12.15 from 4:30 PM - 7:00 PM

Textbooks.

1. Bosq, D., 1998, Nonparametric Statistics for Stochastic Processes, Springer-Verlag, New York.

2. Li, Q. and J. S. Racine, 2007, Nonparametric Econometrics: Theory and Practice, Princeton University Press, Princeton.

3. Pagan, A. and A. Ullah, 1999, Nonparametric Econometrics, Cambridge University Press, Cambridge.

4. Fan, J. and Q. Yao, 2003, Nonlinear Time Series, Springer Verlag, New York.

5. I will distribute class notes. Read them carefully. They reflect my view of the most important concepts/theorems we cover in the course.

Support and Reference Books.

A. Mathematics, Probability, Statistics and Asymptotic Theory

1. Apostol, T., 1974, Mathematical Analysis, Addison Wesley, New York.

2. Bartle, R., 1966, Elements of Integration, John Wiley and Sons, New York.

3. Davidson, J., 1994, Stochastic Limit Theory, Oxford University Press, Oxford.

4. Dhrymes, P., 1989, Topics in Advanced Econometrics: Probability Foundations, Springer Verlag, New York.

5. Grimmett, G.R. and D.R. Stirzaker, 1992, Probability and Random Processes, Oxford University Press, Oxford.

6. Jacod, J. and P. Protter, 2000, Probability Essentials, Springer, Berlin.

7. Luenberger, D., 1969, Optimization by vector space methods. John Wiley and Sons, New York.

8. Massopust, P., 2010, Interpolation and Approximation with Splines and Fractals, Oxford University Press, Oxford.

9. Royden, H., 1988, Real Analysis, Macmillan, New York.

10. van der Vaart, A., 1998, Asymptotic Statistics, Cambridge University Press, Cambridge.

B. Nonparametric Methods

1. de Boor, C., 2001, A Practical Guide to Splines, Springer, Berlin.

2. Eubank, R., 1999, Nonparametric Regression and Spline Smoothing, Second Edition, Marcel-Dekker, New York.

3. Fan, J. and I. Gijbels, 1996, Local Polynomial Modeling and its Applications, Chapman and Hall, London.

4. Härdle, W., 1990, Applied Nonparametric Regression, Cambridge University Press, Cambridge.

5. Prakasa-Rao, B.L.S., 1983, Nonparametric Functional Estimation, Academic Press, New York.

6. Simonoff, J.S., 1996, Smoothing Methods in Statistics, Springer-Verlag, Berlin.

7. Wand, M. P. and Jones, M. C.,1995, Kernel Smoothing, Chapman and Hall, London.

C. Computer Software

1. Aptech Systems, Inc., Gauss - System and Graphics Manual, Vol. I.

2. Aptech Systems, Inc., Gauss - Command References, Vol. II.

Topics.

1. Univariate and Multivariate Density Estimation

   1.1 An overview
   1.2 The Rosenblatt kernel estimator and its properties
   1.2.1 Under IID assumptions
   1.2.2 Under mixing assumptions
   1.3 Bandwidth choice: an introduction to cross-validation and plug-in methods
   1.4 Some variations on the basic estimator

2. Nonparametric Regression Estimation

   2.1 The Nadaraya-Watson estimator
   2.2 The Local Polynomial estimator

2.3 Finite Sample and Asymptotic Properties
2.3.1 Under IID Assumptions
2.3.2 Under Mixing Assumptions
2.4 Bandwith choice
2.5 Selected Applications and Implementation *via* GAUSS.

3. Additive Models of Regression

2.1 The backfitting estimation
2.2 Marginal integration estimation
2.3 A brief introduction to splines
2.4 The spline backfitted kernel Estimator
2.5 Asymptotic properties and oracle efficiency

4. Variance estimation

4.1 Residual based local linear estimation
4.2 Residual based local exponential estimation
4.3 Parametric estimation based on nonparametric residuals

5. Selected topics in Nonparametric and Semi-Parametric Modeling

5.1 Nonparametric Frontier Estimation
5.2 Local Likelihood Estimation
5.3 Semiparametric models for regression
5.4 Two-Stage Estimation

The articles listed below are either original formulations of the topics or models described in class or seminal contributions that help the understanding of the topics under study. I will refer to them in class in various occasions.

1. Aigner, D., C. A. K. Lovell and P. Schmidt, 1977, Formulation and estimation of stochastic frontiers production function models. Journal of Econometrics, 6, 21-37.

2. Buja, A., T. Hastie and R. Tibshirani, 1989, Linear Smoother and Additive Models, Annals of Statistics, 17, 453-555.

3. Fan, J., 1992, Design adaptive nonparametric regression. Journal of the American Statistical Association, 87, 998-1004.

4. Fan, Y., Q. Li and A. Weersink, 1996, Semiparametric estimation of stochastic production frontier models. Journal of Business and Economic Statistics, 14, 460-468.

5. Graves, L. M., 1927, Riemann integration and Taylor's Theorem in general analysis. Transactions of the American Mathematical Society, 29,163-177.

6. Hastie, T. and R. Tibshirani, 1990, General Additive Models, Statistical Science, 1, 297-318.

7. Mack, Y.P. and B.W. Silverman, 1982, Weak and strong uniform consistency of kernel regression estimates, Zeitschrift für Wahrscheinlichkeitstheorie, 61, 405-415.

8. Kim, W., O. Linton, N. Hengartner, 1999, A Computationally Efficient Oracle Estimator for Additive Nonparametric Regression with Bootstrap Confidence Intervals, Journal of Computational and Graphical Statistics, 8, 278-297.

9. Linton, O. B. and J.P. Nielsen, 1995, A Kernel Method for Estimating Structured Nonparametric Regression based on Marginal Integration, Biometrika, 82, 93-100.

10. Linton, O.B. and W. Härdle, 1996, Estimating Additive Regression Models with Known Links, Biometrika, 83, 529-540.

11. Linton, O., 1997, Efficient Estimation of Additive Nonparametric Regression Models, Biometrika, 84, 469-473.

12. Linton, O., 2000, Efficient Estimation of Generalized Additive Nonparametric Regression Models, Econometric Theory, 16, 502-523.

13. Mammen, E., O. Linton and J. Nielsen, 1999, The existence and asymptotic properties of a backfitting projection algorithm under weak conditions, The Annals of Statistics, 27, 1443-1490.

14. Mammen, E., J.S. Marron, B.A. Turlach and M.P. Wand, 2001, A general projection framework for constrained smoothing, Statistical Science, 16, 232-248.

15. Martins-Filho, C. and F. Yao, 2007, Nonparametric frontier estimation via local linear regression. Journal of Econometrics, 141, 283-319.

16. Martins-Filho, C. and F. Yao, 2009, Nonparametric regression estimation with general parametric error covariance, Journal of Multivariate Analysis, 100, 309-333, 2009.

17. Martins-Filho, C. and F. Yao, 2010, Nonparametric stochastic frontier estimation via profile likelihood, University of Colorado at Boulder, Department of Economics working paper.

18. Masry, E. and J. Fan, 1997, Local polynomial estimation of regression functions for mixing processes, Scandinavian Journal of Statistics, 24, 165-179.

19. Newey, W. and D. McFadden, 1994, Large sample estimation and hypothesis testing. In: R. F. Engle and D. L. McFadden, (Eds.), Handbook of Econometrics, Volume 4. Elsevier Science B.V., Amsterdam.

20. Noda, K., 1976, Estimation of a Regression Function by the Parzen Kernel-Type Density Estimators, Annals of The Institute of Mathematical Statistics, 28, 221-234.

21. Opsomer, J. and D. Ruppert, 1997, Fitting a Bivariate Additive Model by Local Polynomial Regression, Annals of Statistics, 25, 186-211.

22. Opsomer, J. and D. Ruppert, 1998, A Fully Automated Bandwidth Selection Method for Fitting Additive Models, Journal of the American Statistical Association, 93, 605-619.

23. Parzen, E., 1962, On Estimation of a Probability Density Function and Mode, Annals of Mathematical Statistics, 33, 1065-1076.

24. Robinson, P.M., 1988, A Root-N Consistent Semiparametric Regression, Econometrica, 56, 931-954.

25. Rosenblatt, M., 1956, Remarks on some nonparametric estimates of a density function, Annals of Mathematical Statistics, 27, 832-838.

26. Ruppert, D., S. Sheather and M. P. Wand, 1995, An effective bandwidth selector for local least squares regression. Journal of the American Statistical Association, 90, 1257-1270.

27. Ruppert, D. and M. Wand, 1994, Multivariate Locally Weighted Least Squares Regression, Annals of Statistics, 22, 1346-1370.

28. Severini, T., 2000, Likelihood methods in statistics. Oxford University Press, Oxford.

29. Severini, T. and W. H. Wong, 1992, Profile likelihood and conditionally parametric models. Annals of Statistics, 20, 1768-1802.

30. Sheather, S.J. and M.C. Jones, 1991, A Reliable Data based bandwith Selection Method for Kernel Density Estimation, Journal of the Royal Statistical Society B, 53, 683-690.

31. Simar, L. and P. Wilson, 2006, Statistical inference in nonparametric frontier models: recent developments and perspectives. In: H. Fried, C. A. K. Lovell, and S. S. Schmidt, (Eds.), The Measurement of Productive Efficiency, 2nd edition. Oxford University Press, Oxford.

32. Staniswalis, J., 1989, On the kernel estimate of a regression functionin likelihood based models. Journal of the American Statistical Association, 84, 276-283.

33. Stone, C.J., 1984, An Asymptotically Optimal Window Selection Rule for Kernel Density Estimates, The Annals of Statistics, 12, 1285-1297.

34. Stone, C.J., 1982, Optimal Global Rates of Convergence for Nonparametric Regression, The Annals of Statistics, 10, 1040-1053.

35. van der Vaart, A., 1999, Semiparametric statistics. Lecture notes, Vrije Universiteit Amsterdam.

36. Wang, L. and Yang, L., 2007, Spline-backfitted kernel smoothing of nonlinear additive autoregression model, Annals of Statistics, 45, 2474-2503.